Line infections and other biofilm-associated infections

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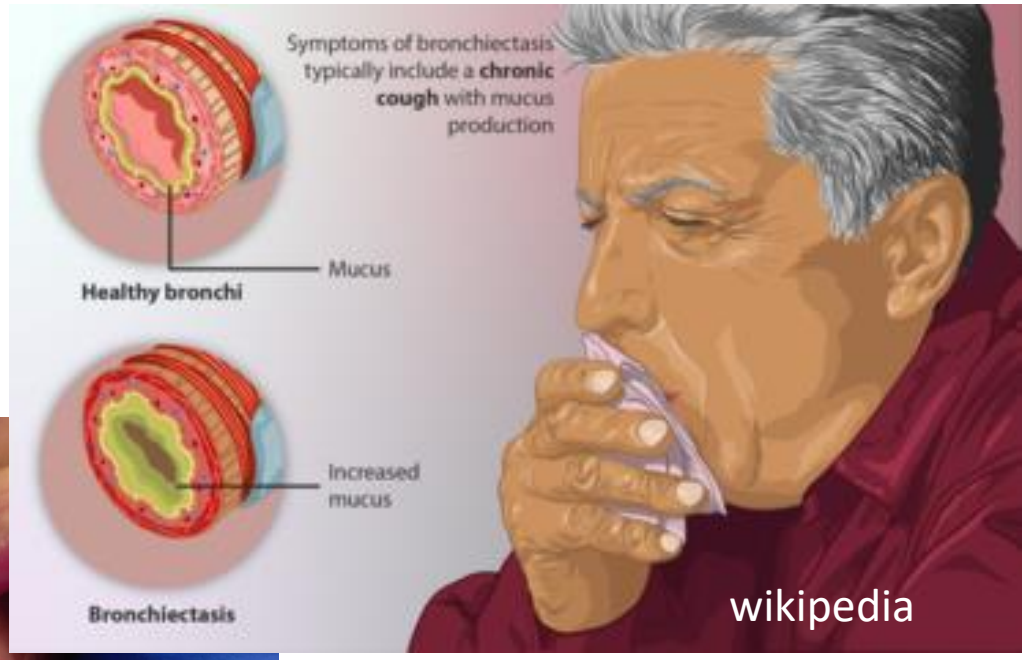
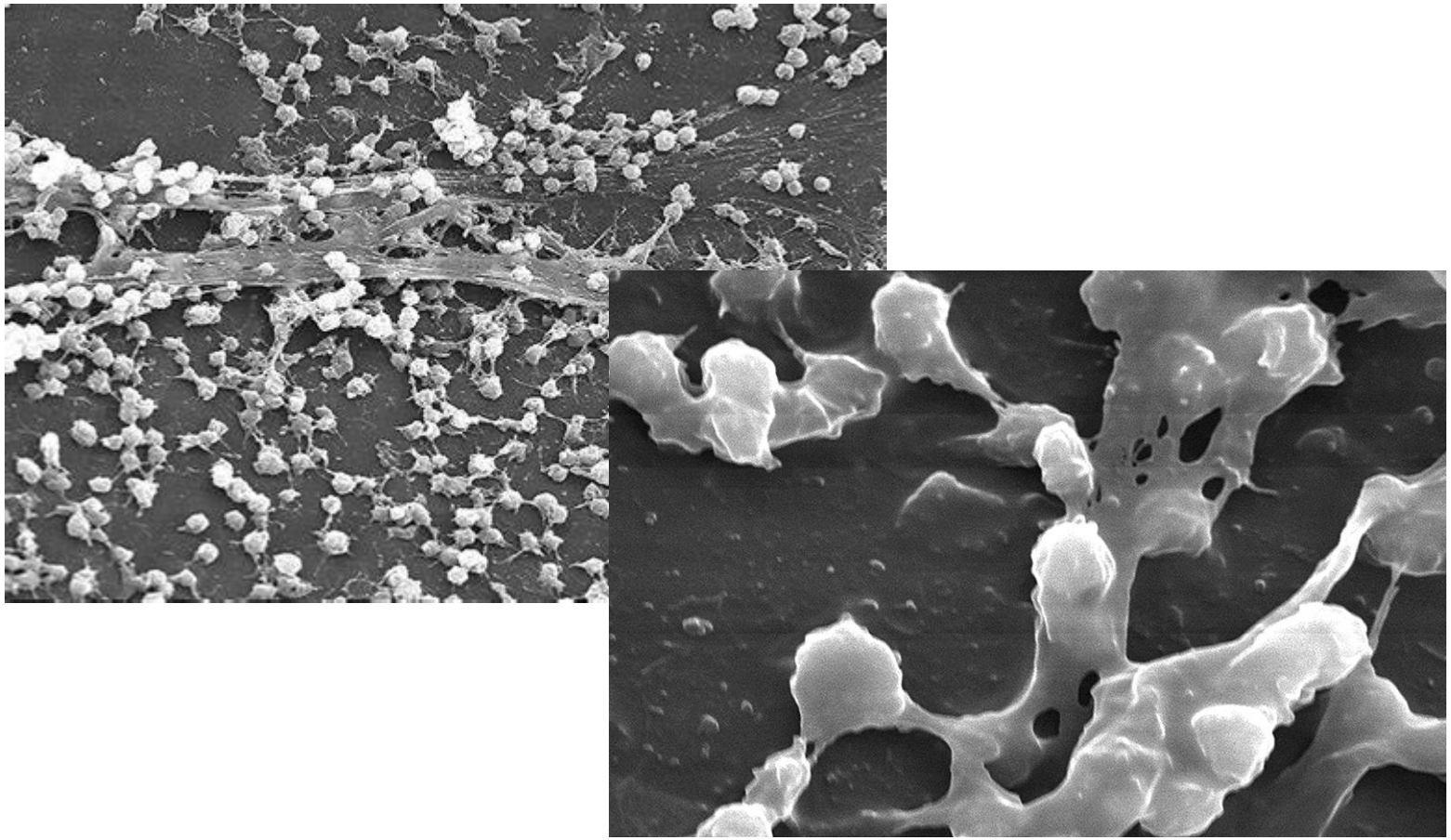
wikimedia


Symptoms of bronchiectasis typically include a chronic cough with mucus production
Mucus
Healthy bronchi
Increased mucus
Bronchiectasis
wikipedia



- Prosthetic heart valve
- Vascular grafts
- Joint prostheses
- Intravascular lines
- VP shunts

BIOMATERIALS ACCUMULATE BIOFILM - INFECTION RISK

Antibiotic resistance in biofilm

- Reduction of antibiotic susceptibility by x 10-1000 based on MIC

WHY?

?biofilm prevents penetration of antibiotic

?biofilm slows down antibiotic distribution

?biofilm inactivates antibiotics

Biofilm organisms are metabolically down-regulated

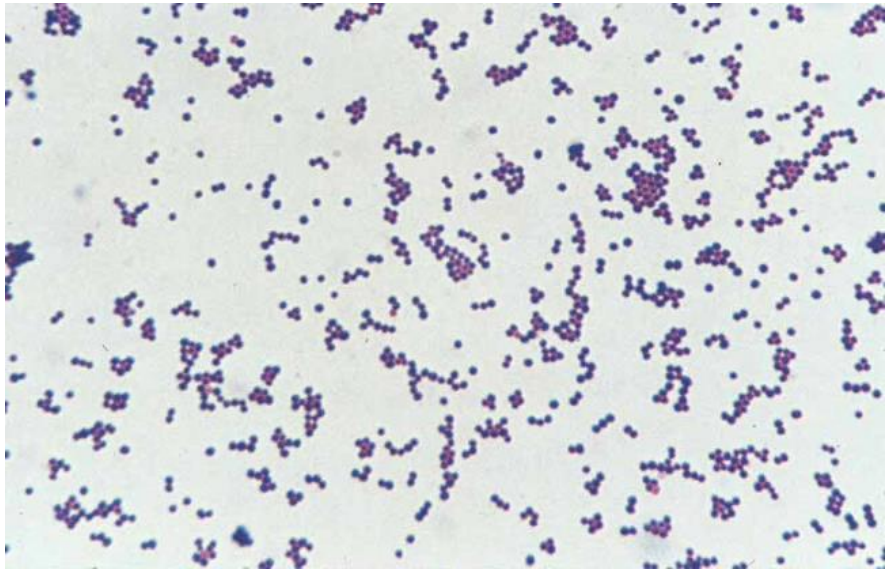
Some pathogens which commonly produce biofilm

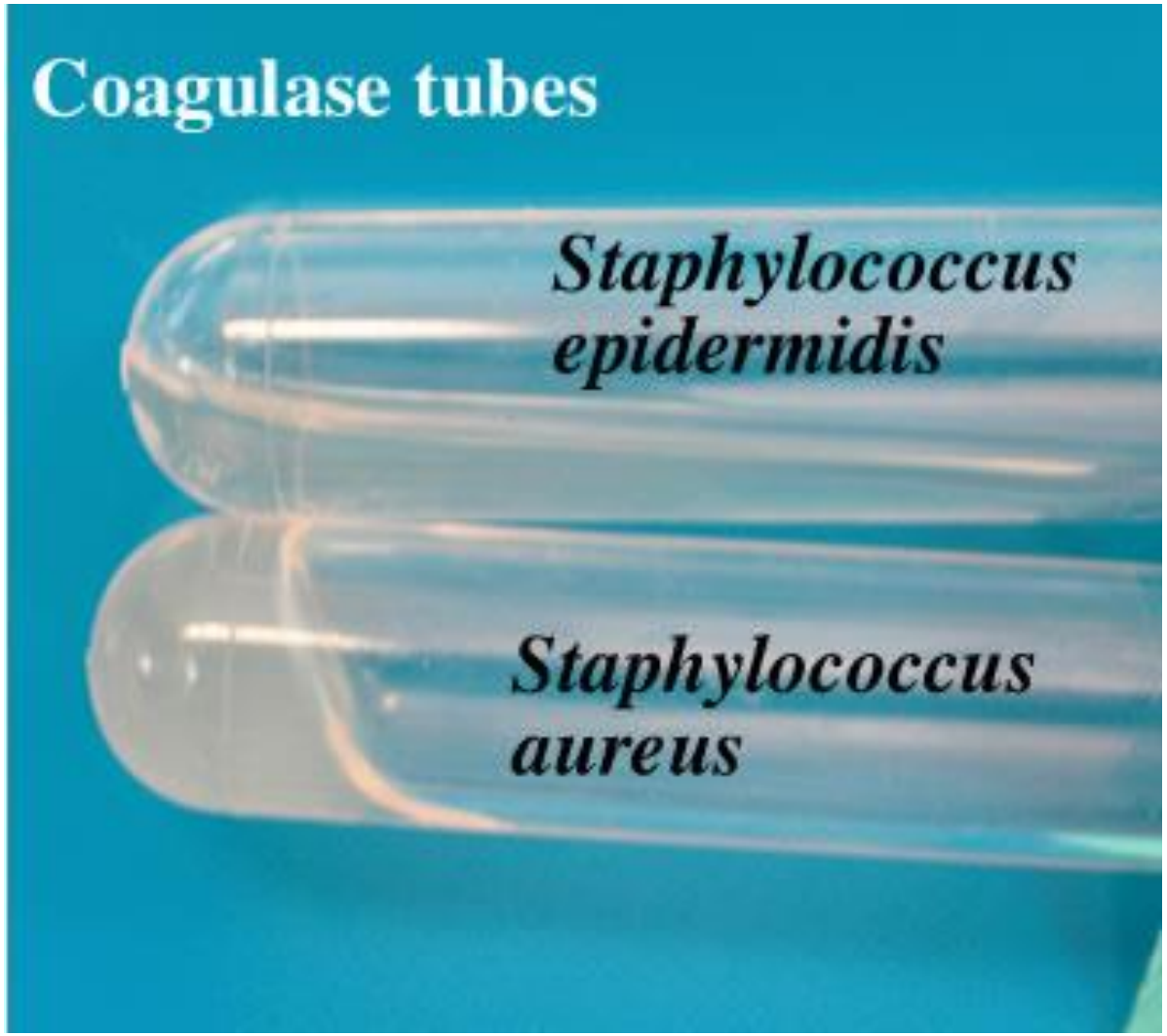
- *Staphylococcus aureus*
- Coagulase negative staphylococci
- *Pseudomonas aeruginosa*
- *Candida sp*

- Also *E. coli/Klebsiella*
- *Enterococcus*

Staphylococci

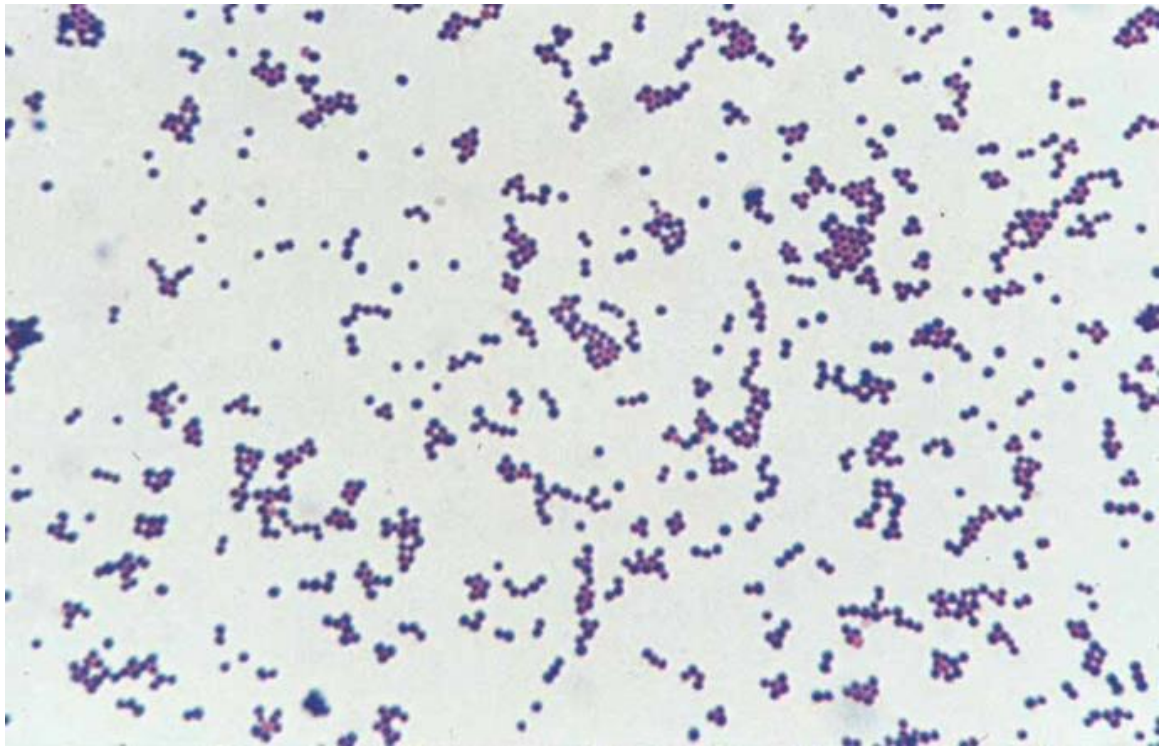
- Staphylococci
  - GPC in clusters
  - Coagulase positive – *S. aureus*
  - Coagulase negative staphylococci





The Virtual Edge (uwyo.edu)

S. aureus



- *S. aureus* is a commensal of ~30% humans
- Can be highly pathogenic – many virulence factors
- Can cause infections of skin, soft tissues, bone, heart valves, joints, biomaterials/lines, abscesses...
- Have a tendency to seed distantly and recur later if not adequately treated

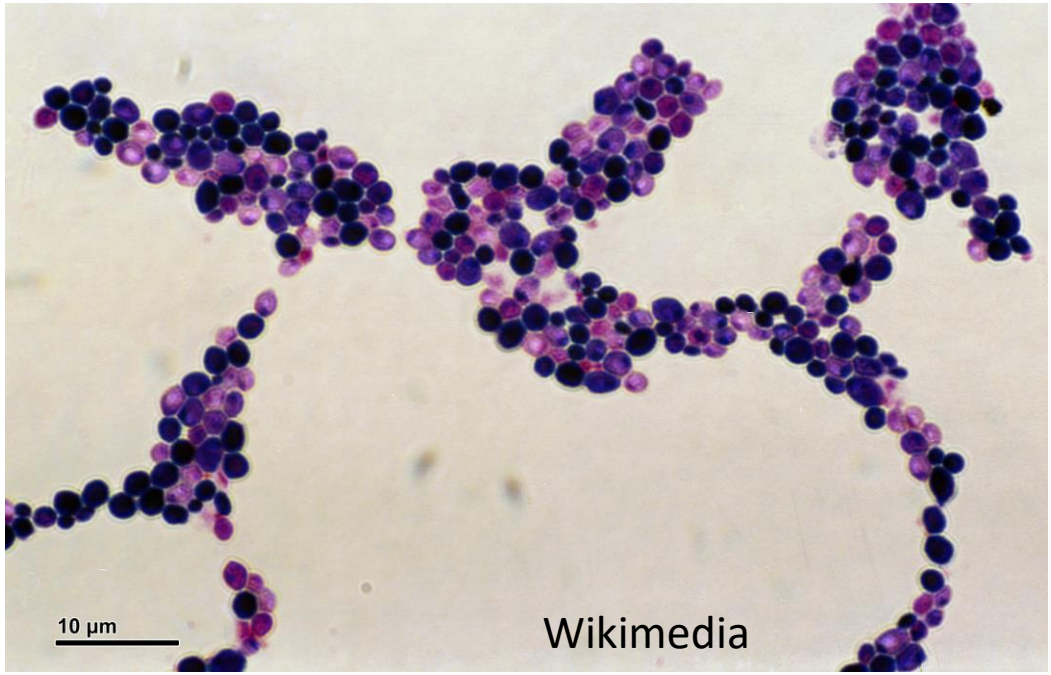
S. aureus bacteraemia

- *S. aureus* in blood cultures is very rarely a contaminant
- Management in a nutshell:
  - high-dose iv flucloxacillin if sensitive
  - If MRSA, iv vancomycin/teicoplanin instead
  - Treat for **14 days, or more** if complicated
  - **Identify source**
    - If source is a biomaterial, needs to come out
  - watch out for endocarditis as a complication
    - Echo

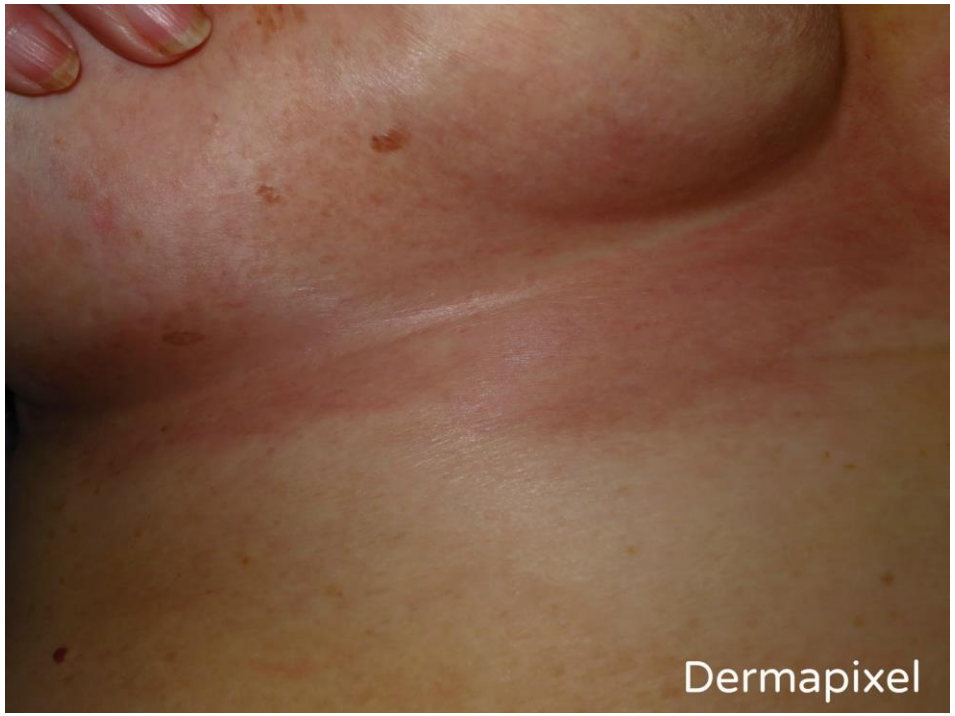
Coagulase negative staph in a BC

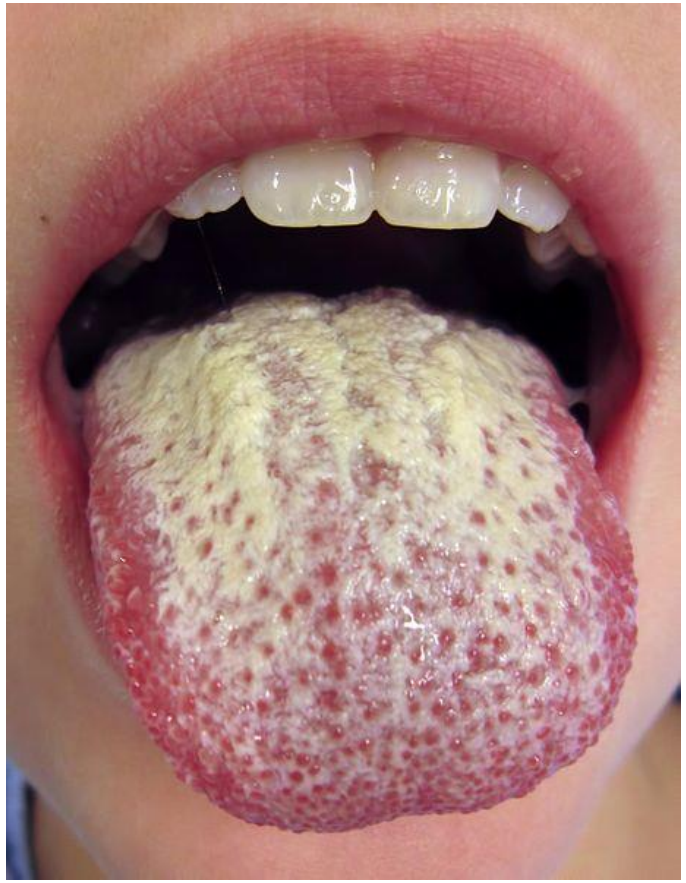
- ?? Significance - clinical assessment
- repeat BC – is it persistent?
- Does the patient have
  - iv line?
  - Prosthetic/diseased heart valves?

Candida sp



- Yeast
- *Candida albicans* vs non-albicans species (others)
  - Non-albicans tend to be more drug resistant esp. azoles





Candida in blood cultures: candidaemia

- Very rarely a contaminant
- Critical care
  - Source is usually an iv line
- Haematology/oncology
  - Source is usually either an iv line or the gut

Management of candidaemia

- Antifungal treatment
- Manage line
- Further investigations

Antifungal options in candidaemia

Fluconazole

- If not had azoles before
- If species is albicans
- Non-neutropaenic and stable

Liposomal amphotericin

Caspofungin (an echinocandin)

- Species is non-albicans
- Neutropaenic
- Critically ill
- (Take advice from team or microbiologist)

Candidaemia – further investigations

- Daily blood cultures until negative – treat for 14 days after BC negative
- ophthalmoscopy for eye lesions
- Exclude endocarditis – Echo is advisable

Wikipedia

Candida - line management

- Non-neutropaenic - remove line asap (consult team)
- Neutropaenic - remove line if at all possible - d/w team
  - Gut source is possible but v difficult to distinguish

Candidaemia – useful guidance

- Infectious Disease Society of America 2016 update

  cid.oxfordjournals.org/content/early/2015/12/15/cid.civ933.full.pdf

- European Society of Clinical Microbiology and Infectious Diseases 2012

  https://www.ncbi.nlm.nih.gov/pubmed/23137135

Catheter related blood-stream infection: CR-BSI

- catheter-BSI are the most frequent infections in critical care units in UK.
- Catheter-BSI increase length of stay (LOS) in hospital and risk of complications
- Annual costs to the NHS estimated at £19.1–36.2M.
- Most catheter-BSI are thought to be preventable using evidence-based educational interventions

Catheter related blood-stream infection: diagnosis

- Gold standard involves quantitative culture of catheter tip
  - Many unnecessary catheter removals
- Pragmatically, if catheter is still needed, take two blood culture sets:
  - through the line
  - peripherally

Guidelines for the systemic treatment of catheter infections by pathogen

UK Medicines Information (UKMi) pharmacists for NHS healthcare professionals
Date prepared: 26th August 2011

Infection	Catheter removal generally recommended	Recommended Antibiotics	Length of treatment
S aureus (Methicillin-sensitive)	Yes – failure to remove catheter leads to significant morbidity	Penicillinase-resistant penicillin	At least 14 days [a]
S aureus (Methicillin-resistant)	Yes – failure to remove catheter leads to significant morbidity	Glycopeptide, linezolid[b] (if glycopeptide resistance), daptomycin	At least 14 days [a]
Coagulase-negative staphylococci	No	Penicillinase-resistant penicillin Glycopeptide [c] if methicillin resistance	5-7 days after defervescence[d] If line retained treat for 10-14 days
Enterococci	No	Aminopenicillin ± aminoglycoside Or glycopeptide ± aminoglycoside if ampicillin resistance	5-14 days after defervescence
Candida albicans	Yes	Azole, echinocandin or amphotericin –b lipid based formulation	Treat for 14 days following first negative blood culture [a]
Others	Dependent on pathogen	As per sensitivity	Dependent on pathogen

[a]Consider treatment for 4-6 weeks in patients at risk of endocarditis.or with persistent bacteremia or fungemia 72 hours after initiation of appropriate antimicrobials, or removal of the catheter. In confirmed endocarditis or osteomyelitis consider up to 8 week's antimicrobial therapy .

[b]Linezolid should not be used for empirical therapy

[c] Vancomycin is preferred if there is local teicoplanin resistance

[d] defervescence – return to normal temperature

Risk factors

- Catheter-BSI most often result from inadequate hygiene and suboptimal catheter management procedures, including:
  - inadequate **hand hygiene** by hospital staff
  - inadequate **skin hygiene** at the site of patients' catheter insertion
  - **suboptimal location** of catheters
  - **unnecessary placement** of catheters
- patient's age
- underlying disease
- duration of catheterisation

Recommended evidence-based practices

- Selection of an appropriate catheter type
- Avoid the femoral insertion site
- antimicrobial cleansing of the insertion site
- maximal sterile barrier precautions and aseptic technique (gloves, mask, hat, patient drapes) during catheter insertion
- use of a sterile semipermeable transparent dressing to allow observation of the insertion site
- NHS has developed ‘Saving Lives’ tools, which include ‘high-impact’ care bundles for CVCs and peripheral intravenous cannulae
  - stress the importance of staff education